

Claims

1. A process for producing a synthetic resin foam comprising the step of reacting at least one polyol with at least one polyisocyanate compound in the presence
5 of an organic blowing agent and a catalyst, wherein the blowing agent is a mixture comprising 1,1,1,3,3-pentafluorobutane and at least one halogen-containing compound.

2. A process according to Claim 1, wherein the
10 organic blowing agent further comprises at least one member selected from the group consisting of glycol compounds and amide compounds.

3. A process according to Claim 1, wherein the organic blowing agent further comprises at least one
15 glycol compound.

4. A process according to Claim 1 or 2, wherein the process comprises the step of mixing the organic blowing agent with the at least one polyol, a premix obtained according to the step being substantially
20 nonflammable.

5. A process according to Claim 1 or 2, wherein the halogen-containing compound has a boiling point lower than the boiling point of HFC-365mfc (40°C).

6. A process according to Claim 1 or 2, wherein
25 the halogen-containing compound is nonflammable and has a

boiling point of about 10 to about 60°C and a thermal conductivity when it is in the gaseous state of about 8 to about 20 mW/mK at about 1 atmospheric pressure.

7. A process according to Claim 2, wherein the
5 halogen-containing compound is nonflammable and has a boiling point of about -90 to about 10°C and a thermal conductivity when it is in the gaseous state of about 8 to about 30 mW/mK at about 1 atmospheric pressure.

8. A process according to Claim 1 or 2, wherein
10 the halogen-containing compound is at least one member selected from the group consisting of saturated or unsaturated hydrofluoroethers (HFEs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and fluoriodocarbons (FICs).

15 9. A process according to Claim 1 or 2, wherein the halogen-containing compound is at least one member selected from the group consisting of 1,2,2-trifluoroethylene trifluoromethyl ether ($\text{CF}_2=\text{CFOCF}_3$), 1,2,2-trifluoroethylene 1,1,2,2,3,3,3-heptafluoropropyl
20 ether ($\text{CF}_2=\text{CFOCF}_2\text{CF}_2\text{CF}_3$), perfluoropropyl epoxide ($\text{CF}_3\text{CF}(\text{O})\text{CF}_2$), perfluoro-1-butene ($\text{CF}_2=\text{CFCF}_2\text{CF}_3$), perfluorohexenes (C_6F_{12}), perfluorononenes (C_9F_{18}), perfluorohexane (C_6F_{14}), perfluorocyclobutane ($\text{C-C}_4\text{F}_8$), iodotrifluoromethyl (CF_3I), 1,1,1,2,3,3-hexafluoropropane
25 ($\text{CF}_3\text{CFHCF}_2\text{H}$), 1,1,1,3,3,3-hexafluoropropane ($\text{CF}_3\text{CH}_2\text{CF}_3$),

1,1,1,2,3,3,3-heptafluoropropane ($\text{CF}_3\text{CFHCF}_3$),
pentafluoroethane ($\text{CF}_3\text{CF}_2\text{H}$), tetrafluoroethanes (CHF_2CHF_2 ,
 CF_3CFH_2), trifluoromethane (CF_3H), 1,1,2,2,3,3,4,4-
octafluorobutane ($\text{CF}_2\text{HCF}_2\text{CF}_2\text{CF}_2\text{H}$), 1,1,1,2,2,3,4,5,5,5-
5 decafluoropentane ($\text{CF}_3\text{CF}_2\text{CFHCFHCF}_3$), 2-trifluoromethyl-
1,1,1,2,3,4,5,5,5-nonafluoropentane ($\text{C}_6\text{F}_{12}\text{H}_2$),
3,3,4,4,5,5,6,6,6-nonafluoro-1-hexene ($\text{F}(\text{CF}_2)_4\text{CH}=\text{CH}_2$),
2,3,3,4,4,5,5-heptafluoro-1-pentene ($\text{CH}_2\text{CFCF}_2\text{CF}_2\text{CF}_2\text{H}$),
trifluoroethylene (CF_2CFH), 1,1,2,2-tetrafluoroethyl
10 difluoromethyl ether ($\text{CF}_2\text{HCF}_2\text{OCHF}_2$), 1,1,2,2-
tetrafluoroethyl methyl ether ($\text{CF}_2\text{HCF}_2\text{OCH}_3$), 2,2,2-
trifluoroethyl 1,1,2,2-tetrafluoroethyl ether
($\text{CF}_3\text{CH}_2\text{OCF}_2\text{CF}_2\text{H}$), 1,1,2,3,3,3-pentafluoropropyl methyl
ether ($\text{CF}_3\text{CFHCF}_2\text{OCH}_3$), nonafluorobutyl methyl ether
15 ($\text{C}_4\text{F}_9\text{OCH}_3$), 1-trifluoromethyl-1,2,2,2-tetrafluoroethyl
methyl ether ($(\text{CF}_3)_2\text{CFOCH}_3$), perfluoropropyl methyl ether
($\text{CF}_3\text{CF}_2\text{CF}_2\text{OCH}_3$), 2,2,3,3,3-pentafluoropropyl difluoromethyl
ether ($\text{CF}_3\text{CF}_2\text{CH}_2\text{OCHF}_2$), 1,2,3,3,4,4-hexafluorocyclobutane
($c\text{-C}_4\text{F}_6\text{H}_2$), 2,3-dichlorooctafluorobutane ($\text{CF}_3\text{CFClCFClCF}_3$,
20 boiling point: 63°C), 1-chloro-1,1,2,2,3,3,4,4-
octafluorobutane ($\text{CF}_2\text{ClCF}_2\text{CF}_2\text{CF}_2\text{H}$, boiling point: 50°C),
1,2-dichlorohexafluorocyclobutane ($-\text{CFClCFClCF}_2\text{CF}_2-$,
boiling point: 60°C), and 1,1,1,3,3,3-hexafluoropropan-2-
ol ($\text{CF}_3\text{CH}(\text{OH})\text{CF}_3$, boiling point: 59°C).

25 10. A process according to Claim 1 or 2, wherein

the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: $\text{CF}_3\text{CFHCF}_3$).

11. A process according to Claim 1 or 2, wherein the proportion of halogen-containing compound is about 1 to about 49 mol per 100 mol of HFC-365mfc and halogen-containing compound in total.

12. A process according to Claim 1 or 2, wherein the catalyst is a tertiary amine, an organometallic compound, or a mixture thereof.

13. An organic blowing agent for producing a synthetic resin foam, the organic blowing agent comprising 1,1,1,3,3-pentafluorobutane and at least one halogen-containing compound.

14. A blowing agent according to Claim 13 further comprising at least one member selected from the group consisting of glycol compounds and amide compounds.

15. A blowing agent according to Claim 13 further comprising at least one glycol compound.

16. A blowing agent according to Claim 13, wherein the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: $\text{CF}_3\text{CFHCF}_3$).

17. A premix for producing a synthetic resin foam, the premix comprising 1,1,1,3,3-pentafluorobutane, at least one halogen-containing compound and at least one polyol.

18. A premix according to Claim 17 further comprising at least one member selected from the group consisting of glycol compounds and amide compounds.

19. A premix according to Claim 17 further comprising at least one glycol compound.

20. A premix according to Claim 17, wherein the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: $\text{CF}_3\text{CFHCF}_3$).

21. A premix according to Claim 17 or 18 that is nonflammable.